Attitudes Toward Advanced Automotive Display Systems: Feedback from Driver Focus Group Discussions

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16. Abstract

Forty-six drivers of late model cars equipped with advanced information systems participated in four focus groups conducted in Los Angeles and New York. The sessions provided insights into drivers' perceptions of the value of these systems, including strengths, weaknesses, and potential improvements for future systems.

Drivers expressed greatest interest in systems that warn of potential hazards from their vehicles or the road. These systems must provide information in a timely manner to allow appropriate corrective actions.

There were complaints about attention being diverted from driving while operating entertainment systems and cellular phones. The need was identified to integrate cellular phone controls on the dashboard, hands-free dialing, and easier identification of key controls.

There is also an interest in navigational systems. Interest was expressed for a system that provides a head-up display to address safety concerns related to reading directions.

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INTRODUCTION

Over the last several years, automobiles have become more sophisticated with a variety of computers controlling many automobile functions. Moreover, advanced electronic technologies have also allowed for the addition of new devices such as trip computers, sophisticated radios, cellular phones, and touch display screens. The future promises even more complicated systems.

As cars incorporate more of these systems, the driving experience changes. There are new and more instruments to monitor and buttons to push. Some of these changes may contribute to safer driving, but others may increase the complexity of the driving task.

As new systems are developed and incorporated in automobiles, it is vital that they be designed so as to increase the pleasure and safety of the driving experience. They must be designed to fit in with the way people use their cars as well as meeting their driving needs. Moreover, they must be designed to improve rather than impair the safety of the car's drivers and passengers.

This report presents the results of the first phase of an extensive project designed to evaluate advanced display systems in automobiles. Its intent is to evaluate both the perceived current safety of these systems and how they can be made easier to use.

Finally, the overall project will examine future technologies and the directions that should be taken to best meet consumer needs and safety concerns.

This phase was designed to give direction to the larger project. In particular, its aim was to provide actual consumer feedback on their experiences with display systems, to gather reactions to future developments, and to determine in very rough ways what forms these new systems should take.

GENERAL APPROACH

The objective of this project as stated above was to study the reactions of consumers to gain a thorough understanding of their experience and attitudes toward visual display systems and future technologies. This was accomplished through the use of the depth group interview.

The intensive depth group interview is a proven research technique based on the psychiatric group therapy technique. It involves approximately ten people sitting and talking with a highly trained moderator. One of the major features of the group interview is its challenge and response character. The moderator almost always assumes that the first response to a question is not the real answer. A challenge to that response forces the individual to prove the statement. This atmosphere affects the other members of the group and they begin to challenge each other. The respondent who is "on the spot" wants desperately to defend the expounded point of view. In so doing, the challenged party must dig deeply into the psyche for the real answers. The process is repeated with every panel member. A group consensus of "truth" finally emerges from such a dialogue. It is not at all uncommon to have panelists tell the moderator at the conclusion of the group that they understand themselves better than they did before the discussion.

Most importantly, during the group session the moderator is also stimulated by what people say. The experienced, creative moderator will continually develop hypotheses to explain the behavior patterns being discovered. The very nature of the discussion -- that is, its flexibility -- allows the immediate testing of these hypotheses within the group.

The group interview is quite different from the individual interview. An individual interview only has meaning when it is averaged in as part of a much larger sample. In contrast, the intensive depth group interview session is a total study by itself. It has its own personality, attitudes, and emotions. At the conclusion of any group, the moderator should be in a position to write a full report designed to meet the objectives of the study.

The scope of this phase of the project was very narrow. It was intended to do no more than to touch base with consumers and to provide input for later, more comprehensive phases of the larger project. A total of four depth group interviews were conducted -- two in Los Angeles, California, and two in Stamford, Connecticut (near New York City). These markets were selected because they include heavy traffic patterns. Los Angeles was also selected because it is considered a "leading edge" market -- where new ideas and products are most readily considered. It was believed that these drivers would have intense interactions with their cars. Thus, given the limited

scope of the study, they would be able to provide the greatest insights about their experience with their cars.

In each market, two sessions were conducted. One of the two sessions included slightly older respondents (over 50 years old). Some of the older respondents experienced some physical impairments which affect their driving, such as arthritis, night vision, or other problems. The second set of sessions was conducted among younger people. It was divided evenly between those 21 to 35 years old and those 36 to 50 years old. Roughly two-thirds of the respondents were males.

Respondents were carefully screened to include individuals who currently have many of the technologies to be discussed (cellular phones, head-up displays, etc.) in their vehicles. Those who did not had to be at least aware of some of these technologies. To aid in this selection, all the respondents drove cars purchased within the last two to three years. The respondents were also screened to ensure that they regularly drove in heavy traffic.

Respondents were selected through a combination of random telephone recruiting, referrals from known individuals and automotive dealerships. Respondents were encouraged to participate by the description of the session's purpose and a financial incentive ($75 in New York and $50 in Los Angeles). A copy of the questionnaire used to screen respondents may be found in the back of the report in Appendix A. Included is a summary of the respondents' age, sex, income, education, the vehicles they drive, and features in their vehicles.

The depth group interview technique is characterized by a free-flowing discussion. Issues are often discussed in the order by which they are brought up by the respondents. The length each subject is discussed varies between sessions based on the degree of input by respondents. A discussion guide is utilized, though, to ensure that all relevant issues are covered during the course of the discussion. For this project, the discussion guide included the following topics:

● Background information on the respondents' vehicles including what features their cars have.

● General attitudes toward sophisticated systems in their vehicles. This included discussions of how they learn to use these features and the nature and extent of their usage of these features.

● A detailed discussion of automotive gauges and warning systems.

● A detailed discussion of entertainment systems.

● A detailed discussion of sophisticated vehicle monitoring systems, such as touch screens and trip computers.

● A detailed discussion of cellular phones and citizen band radios.

● A detailed discussion of navigational systems.

● A detailed discussion of road hazard monitoring systems.

Each of the detailed discussions included respondents' attitudes toward these systems, usage of the system, perceived advantages and disadvantages of current and proposed systems, and recommendations for making the systems more useful, user friendly, and safe.

A copy of the detailed discussion guide utilized in this project may be found in the back of this report in Appendix B.

The group discussions were conducted in Los Angeles, California, on February 20, 1990, and in Stamford, Connecticut, on March 1, 1990. They were conducted in facilities with one-way mirrors and a hidden video camera. The discussions were video and audio tape recorded. All respondents were informed they were being recorded at the onset of each discussion.

CAVEAT

This study is based upon the results of only four groups. Whereas the results of such a small study are *valid*, there is no way in which *statistical reliability* can be ascribed to them. Thus, while the report "validly" states what it is that people think, it cannot "reliably" say the degree to which these thoughts occur throughout the population. Therefore, no statistics are included in this report, only more general categorizations of the results.

Throughout this report frequent use is made of comments by respondents. In many cases these are precisely "verbatim". In other cases, however, they are "representative" of what one or more respondents may have said on a subject.

SUMMARY OF FINDINGS

BACKGROUND OF THE RESPONDENTS

Each session began with respondents briefly telling a little about themselves. This included personal information such as marital status and occupation, as well as information on their vehicles.

For the most part, the respondents were either somewhat upscale socioeconomically, young with high aspirations, or were car enthusiasts. The types of automotive features sought in the respondent screening process led to cars that were more upscale and sophisticated and, thus, to these sorts of consumers. Respondents owned a wide variety of different vehicles ranging from BMWs to Jeep Cherokees, Oldsmobile Cutlass Supremes, Nissan Maximas, Cadillacs, and Corvettes.

One of the interesting findings of this study is that there is a fair amount of confusion about new technologies in cars. This became apparent during the screening process and was further elaborated on as the respondents introduced themselves. Many people are so struck by the sophistication of their vehicles that they will claim that they have numerous features that they actually do not have. These claims are not an attempt to impress others as much as a statement of their beliefs as to the sophistication of their cars. This is illustrated by the common belief among the respondents that their car has "all the bells and whistles".

It is also important to note that there was a distinct difference in the character of the Los Angeles and New York area (Stamford) respondents. It was clear that the Los Angeles respondents were more familiar with the features on their vehicles and used them more heavily than those in New York. People in Los Angeles spend as much as several hours a day in their cars. As some described, "We almost live in them." Some went so far as to explain, "I am almost more concerned with my car than my home." They, therefore, have a much greater attachment to their vehicles and are more likely to utilize and, in fact, rely heavily on some of the sophisticated features. This relationship is primarily due to the combination of the lack of public transportation and the sprawling nature of the Los Angeles Metropolitan area.

While attempts were made to include individuals who currently have as many features as possible on their cars, there was very limited representation of experience with touch screens and head-up displays and very limited awareness of the ETAK Navigational System. This is due to the fact of the limited publicity on these features and their very limited inclusion on current models.

ATTITUDES TOWARD NEW TECHNOLOGIES

Both at the inception of the sessions and at various points later, respondents were questioned on their attitudes toward a variety of technological advances and display systems that had been incorporated in vehicles in recent years. Aside from a handful of technophiles and autophiles, most indicated they do not really pay attention to these features when they are shopping for a car. They are far more concerned with style, spaciousness, price, and other similar issues.

A handful of individuals indicated they avoid these types of features when checking cars. These individuals typically felt that "advanced technology added more to a car's price than to its quality" or that "the more technology a car has the more there is to break down". Conversely, a handful of individuals seek out technology. One such woman purchased a Buick Riviera with a touch display because she was told she could get a navigational system for it. The great majority, though, clearly pay very little attention to these features in evaluating their purchase decision.

The likelihood of these features being used depends heavily on the driver's perception of their value to them. Many of the features discussed were perceived as "toys" that provided fun but not important information. Rarely did they provide necessary or helpful information. This is why many of the features were not used as

extensively as they otherwise would be. This will be discussed more specifically later in the report as individual features are addressed.

While there is only limited excitement about these classes of features prior to the purchase, most make at least some use of them once they purchase their vehicle. Those who drive their cars more, use the features more frequently. This was also true of the autophile and technophile. Others use them either infrequently or on a regular basis only when they first get their cars.

Consistent with the Los Angeles consumers' stronger feelings toward their vehicles, there tended to be more individuals there who paid attention to these types of features. Los Angeles drivers were more likely to perceive a given feature as contributing to their driving experience, making it more fun or more safe. In contrast, respondents in New York were less than enthusiastic about these features.

THE LEARNING PROCESS

Most of the respondents indicated they do read their Owner's Manual extensively when they first obtain a new vehicle in order to learn how to use all the features. The most dedicated describe their experience as "sitting in the driveway for two hours with a manual in front of me learning how to use every feature on the car." More typical were the individuals who read through the manual and gained a fundamental understanding of how to use the features. These individuals would still have problems occasionally when they actually tried to use a feature. At these times, they either referred to the manual or just avoided the specific feature.

Other approaches were also used by a handful of individuals. A handful learned how to use features through a playful "trial and error" approach. A couple were provided audio cassettes that explained the vehicle's operation. Most of the respondents who received these cassettes found them very useful and effective. The concept of learning to use their car features through an audio cassette was appealing to most of the participants. Only those who were least committed to their vehicles indicated they would not use this approach if it were available.

Overall, very few of the respondents found that they had problems learning to use the features on their vehicles. By their own

admission, those who did have problems quite often never really made an effort to learn. "I don't really know what it does, I never quite got to that feature. It just didn't seem all that important."

The most common problems were caused by inconsistencies between vehicles. Individuals who switched back and forth between driving their primary vehicle and a spouse's or a rental car often experienced having to remember where the different features were on the different cars, or trying to learn how to use different controls without a manual. At its most basic level, many complained that "when I rent a car, it is always a game trying to figure out how to turn the lights on". Respondents expressed a desire for more consistency in the types and placement of controls on cars to help overcome their problem.

GAUGES AND WARNING SYSTEMS

One of the most important issues discussed from the respondents' perspective was gauges and warning systems. In the different cars owned by respondents there were numerous approaches utilized from gauges to warning lights to message centers and combinations of the above. Moreover, the specific problem areas monitored on each vehicle also vary dramatically.

Consumer attitudes toward gauges and warning lights at first were very "cut and dried". Most felt that "I have them on my car today and they do a pretty good job." This was not to suggest that they were unimportant. In fact, early in the discussion respondents indicated that "the more 'potential' problems they could learn about, the better". Their somewhat limited concern had more to do with their initial belief that most gauges met their needs.

During the course of the discussion, the initial lack of concern changed. The process began with their unanimous disdain for what many referred to as "idiot lights". Idiot lights were described as "lights that flash on when it's too late to do something about a problem". They were idiot lights because either they had such general purposes that the respondents did not know what the real problem was or because, by the time they flashed on, most thought it was too late and the problem may already have reached an emergency status. Several participants relayed stories such as having been "driving down the

freeway and a warning light went on. I was frozen -- should I pull over, get to a service station? Then I realized that I didn't even know what was wrong!" In reality, they really didn't know what these lights meant most of the time.

It was also discovered, though, that more gauges were not necessarily the answer to problems. Some expressed concern over having too many dials on the dashboard. They find this confusing and creates an undesirable cluttered look. Many also had only a limited understanding of how to interpret the gauges. They knew that "if the needle went into a red area that it wasn't good," but they didn't know "how concerned I should be at that point."

There was an even more fundamental problem -- a general lack of understanding for the implications of the warning lights and gauges. The least knowledgeable, for example, did not know the difference between oil pressure and oil level. Moreover, they did not know the implication of having a problem with these gauges. Even more basically, if a light was to go on or a gauge to go into the red, they were not sure how they should act. Should they pull to the side of the road? Do they need to go to the nearest service station immediately or can they wait to go to a service station of their choice (close to home)?

It was during the course of these specific discussions that true attitudes toward these gauges became apparent. Automobiles today are

viewed as being extremely complex machines. The operation of these machines is far more complex than most drivers can comprehend. Warning systems are relied on as a way to allow them a level of comfort in driving their vehicles. "I drive a lot, sometimes at night, in neighborhoods I am not familiar with, and I don't want to know more about. The thought of my car dying on the road really frightens me!" They rely on these to let them know when there is a potential problem.

Given the way in which drivers rely on these systems, it is important they receive useful information from them. Their perception is that when a light goes on, it is too late to do anything about it. Thus, the systems are in many senses useless in providing the desired sense of security and safety while driving. Ideally, consumers would like these systems to . . .

- provide early warning of potential problems.

- When an early warning is given, they would like it to provide some indication of the urgency of the problem and the required action. This should appear on the dashboard, for example, on a message center that would direct their actions. While some of this information may currently be included in vehicle manuals, these are often cumbersome to use and require stopping to read.

- If a problem becomes more serious, a secondary, more urgent warning should appear, either a different message or a different color light.

● For the most vital functions, such as engine temperature, oil
pressure, alternator, or gasoline level, there should be some form
of combination gauge and warning light. The light would draw
attention to the gauge if a problem should arise.

There is some controversy over the use of auditory signals for warning
systems. Very few, if any, of the respondents want a voice telling
them what is wrong. "I used to have a car that talked to me --
sometimes I just wanted to destroy that hidden voice." Some, though,
do like the idea of an auditory signal to alert them to look at their
gauges for a problem. They believe that this is the best way to be
notified of an apparent problem. Others complained that a signal like
this would frighten them. "If I heard a beeping and saw a light
flashing, I would probably 'jump through the roof'. Instead of
warning me, it would get me in an accident." Many of these
individuals also felt that some form of flashing light would be
frightening.

The discussion above relates primarily to the most important warning
systems -- those that will make the car undrivable. Many vehicles
include some form of warning system for numerous other potential
problems ranging from doors being ajar, to low fluid levels, to
notification of scheduled maintenance. The primary benefit of these
systems is that unlike the past when fluids were checked with a gas
fill-up. The advent of self-service gas stations means that fluids

are checked much less frequently. Thus, while many were hesitant to admit not checking fluids as often as they should, it was clearly an underlying feeling that this could be a useful safety precaution. It would be a nice feature to have but not necessarily one that they would aggressively seek.

VEHICLE COMMUNICATION SYSTEMS

Vehicle communication systems such as citizen band radios and cellular phones were also discussed with a fair amount of emotion. All the respondents either had one of these devices in their car or had very strong opinions about them.

There were two classes of attitudes toward these devices. Many saw them as one of the great advances in technology. "My phone makes me far more productive. I don't have to stop working when I am on the road." Many women, in particular, viewed them as a safety device. "I know that if my car broke down or if I am lost, I can call for help." Others perceived them as impositions. "I look forward to my time in the car. It gives me a chance to relax and reflect. If I had a phone, it would ruin that time."

Generally speaking, there was little concern over the use of telephones for making outgoing or receiving incoming calls among owners. It was easy enough as long as the phone had speed-dialing. Most pointed to the ability to dial with the receiver on the unit, as well as the use of speed-dialing for keeping it safe and easy.

The sessions were divided evenly between those who limited their pick-up of incoming calls and placement of outgoing calls to when they were at a standstill and those who would do it while driving. Non-owners of car phones were particularly nervous at the thought of calls being placed while in motion. Non-owners, on the other hand, recall being

"frightened when I see someone driving with one hand, looking away from the road and dialing a telephone," even with speed-dialing. They would like to see car phones designed so that these activities would only be done while at a standstill.

One suggested improvement to the basic design of cellular phones was the incorporation of controls into the car dashboard or steering wheel itself. The rationale was that if it was easier to reach the controls, the driver would be able to look forward rather than down and to the side. A few individuals have had dialing pads installed on their dashes. Along the same lines, some also suggested that car phones could become voice-activated in the future.

The crux of the matter was a general concern over safety. Most respondents had experiences either of their own or seeing other drivers busily talking on the phone and apparently not paying attention to the road. More often than not, concern rested with the driver holding the receiver. Most felt that this limited the physical ability to control the vehicle in crises and near-crisis situations.

Nearly all respondents agreed that car phones ought to be used strictly on a hands-free basis. They find it difficult to argue with the logic that this would increase safety. In fact, only a handful were opposed to the notion of a law mandating hands-free use. The few who opposed this were concerned about privacy. "There are times when

I need to carry on a conversation that I don't want my passengers to hear."   A few were concerned about other conversations in the car or road noise interfering with their conversations.

ENTERTAINMENT SYSTEMS

Entertainment systems were discussed fairly briefly. Respondents had a variety of systems ranging from a $6,000 sophisticated system to the most basic AM/FM radio. Systems included everything from six disk changers and graphic equalizers to basic radio functions.

The primary concern among respondents when it comes to entertainment systems were the controls.

- Radios are often placed in positions where it is difficult to reach the various controls. This pulls them away from a correct driving position and causes them to take their eyes off the road. Several conveyed stories of "swerving into other lanes while trying to find a good radio station".

- Many entertainment systems have numerous controls. These may range from graphic equalizers to pre-set radio stations, seek and scan buttons, cassette or disk control buttons, and volume buttons. "Sometimes when I am trying to change the volume, I end up changing the station." This is caused by both the number and size of the buttons.

- Some have trouble keeping track of what buttons do what. Is it the seek or the scan that stops at every station? Which button is picked to fast-forward a tape? "I almost have to pull over to work my cassette player."

● Quite often the entertainment system controls are difficult to identify when it is dark. "The buttons on my radio light up, but not the labels. I can't tell what is what at night."

Some respondents suggested making these systems simpler. Some of the most sophisticated audiophiles prefer their systems not to have graphic equalizers. They would rather have a fine manufacturer pre-set it. Many others complained that "I don't know how to set a graphic equalizer. A friend showed me once and I haven't changed it since then".

Others suggested isolating the most frequently used controls to ensure the ease of use. Many liked the idea of controls located on a steering wheel. Only a few thought these would be just as hard to operate. Others suggested making the most important controls larger for ease of operation. At the very least, most agreed that controls should be of a size and mechanism that are easy to operate.

TRIP COMPUTERS

Most of the respondents indicated they had some form of trip computers in their cars. In reality, this ranged from a trip odometer to the most sophisticated trip computer systems.

Attitudes and usage of these systems vary tremendously by individual. Those who relied on their cars less tended to view trip computers as a "toy". This was especially the case in New York. They regularly use the trip odometer but rarely use any other features. "The only times I use my Trip Computer is when I'm sitting in the car waiting for my wife to come out of a store." "I use it now and then on vacation." They saw little value in knowing the average speed. They saw little accuracy in fuel remaining estimates and rarely bothered programming it for the expected time of arrival features.

In contrast, those who relied on their cars most heavily, especially those in California, used their trip computers extensively. Over half of these individuals relied on it for tracking when they needed gasoline. Some business people used the estimated time of arrival for keeping track of whether they were on time for an appointment. These individuals viewed their trip computer as an integral part of their driving experience.

Trip computers include a wide variety of features such as average speed, average fuel economy, estimated miles to the next fuel refill, and expected time of arrival as well as additional vehicle monitoring of key fluids in some systems.

One of the issues which impacts the usefulness of these systems is their perceived accuracy. This was particularly true with the estimated miles before needing to fill the tank. Many of the respondents did not have confidence that this estimate was either accurate or something on which they could rely. They feel far more comfortable taking a more conservative, traditional approach to filling their tank. A number of respondents even gave examples, such as the woman who indicated, "I know that mine is off at least a quarter of a tank".

The estimated time of arrival also had shortcomings. It was only useful if you knew how many miles you had to drive, if you input them at the beginning of your trip and, finally, if the computer could in some way take into account rest stops and/or variations in traffic patterns along the road. When driving to a destination where traffic would be more congested toward the end of the trip, the estimate clearly would not be useful.

Finally, as with many secondary features installed on cars, some respondents complained about the placement of their trip computers. They felt they were difficult to reach. They understood there could only be so many features within easy reach. It limited their perceptions of the features' usefulness.

SOPHISTICATED DISPLAY SYSTEMS

Two sophisticated display systems were discussed during the sessions--
touch screen displays and head-up displays. There was very little
awareness of either of these systems among respondents. Only the few
individuals who had either owned a car or had a friend who owned a car
or were true autophiles were familiar with them.

The nature of these systems was explained to respondents by the
moderator and those participants who had familiarity and experience
with them. In general, the participants were quite taken aback by the
technology.

Touch Screens

Touch screens were initially ridiculed more than anything else for the
notion of having a "TV" in a vehicle and for its perceived complexity.
Many were not surprised by the technology, rather they viewed it as an
extension of the computerization of the automobile.

In each session, there was at least one individual who had some
experience with touch displays. One respondent bought a vehicle
specifically because it had a touch display. She loved the 51 separate
screens that she could access. She found the system to be of great
use, not to mention easy to use.

Others with more casual experience found them extremely complicated
and difficult to use. The necessity of continually changing screens

to get to a specific function was viewed as overwhelming by these individuals. The consensus was that these systems sounded extremely dangerous. If the driver was to interact with the systems while in motion, it would clearly district attention from the driving task. In fact, one respondent who had used one on a rental car exclaimed, "I almost drove off the road trying to use it!"

It was explained that there was a system monitoring screen which could be kept on at all times allowing for control of basic vehicle functions, and that the other screens need only be shown when more sophisticated interactions were required. This did not allay the fears of respondents. The sheer number of different screens was perceived as overwhelming. Moreover, it was seen as adding unnecessary complexity. They could not imagine why a car would ever need so many screens. It was just one more thing that could break down and cause problems.

Head-Up Display

The head-up display was viewed as much more intriguing. Very few were familiar with this type of technology. They could not imagine what it would be like. It was truly "Space Age." Those familiar with advanced airplane technology made that connection.

Most were concerned that the display would impair their visibility, either because it would block their vision or would distract them. The handful of respondents who had head-up displays in their cars said

this was not the case. They were neither distracting nor impairing --
they loved the displays. It is interesting to note, however, that
these individuals primarily used their displays during the night.
They could not explain the rationale behind this.

A real issue of concern was control over the displays. Individuals
were concerned over whether it was on all the time, whether it flashed
on and off automatically at timed intervals, or whether it could be
called up whenever desired. Most preferred a system that they could
control. Similarly, they also wanted to be able to control whether it
shows the speedometer, gauges, or both.

Another concern was brought up by one respondent who had a head-up
display in her car. She indicated the head-up display was bothersome
because of her short height -- it did not shine in the correct spot in
the windshield for her. She wanted some form of control for where it
was displayed on the windshield. Individuals who were tall also
expressed interest in a similar control.

The general concept of head-up displays received mixed reviews.
Roughly half the respondents thought they were conceptually an
excellent idea due to the additional safety provided by not looking
down at the speedometer. They were a little concerned over whether
the safety would be truly realized if they had to start pushing
buttons to have the display turn on and off. Roughly half were not

convinced of its value. They did not feel that their momentary glance at the speedometer created a safety hazard. "I think that having a speedometer flash on the windshield in front of me would be far more distracting and dangerous."

ROAD HAZARD MONITORING SYSTEMS

There are currently a variety of systems in place which allow drivers to monitor potential road hazards. These include electronic signs posted on some expressways, a variety of radio-operated systems, as well as some experimental programs which rely on video monitoring of roads. These systems in general, as well as potential improvements, were discussed at length.

Initially, respondents discussed their experience with existing systems. All of them were familiar with electronic signs located on some freeways. There was almost unanimity that while these have the potential for being helpful in identifying problems ahead, they rarely are in use. Many mentioned that they have frequently "been driving down a road and passed a sign without any messages, then drive into heavy congestion".

The radio-based systems were used quite extensively by many of the individuals. Most were immediately able to name local radio stations with regular traffic updates. They also identified several specific locations such as near airports where they could tune to a specific station for local traffic updates.

Not only were most of the respondents familiar with the broadcasts, they used them regularly. Many indicated that they would tune in the general radio stations when they left for work in the morning. Based on what they heard, they would alter their route. Morning traffic

reports were considered the most important by a majority of the respondents. "I want to make sure that I get to work on time. It usually doesn't matter as much when I get home."

These systems were used less frequently during the rest of the day. In these situations, the stations would only be tuned in either if they were in a hurry, if they knew they were driving into a heavy traffic area or, among a select few, just to check up on what was going on around town. Generally, these were not the kind of entertaining programs they wanted to listen to on a regular basis.

There were two complaints about the radio-based systems. The first had to do with their ability to get information about traffic problems far away from where they live. This was most important when they were either going on vacations or business excursions that took them over wide-ranging areas. They often would have choices between the routes they could take. Selecting a route required insights into the traffic patterns that day. Usually their local stations would not provide this information. The most astute of the respondents call the State Highway Patrol to gain this information. Many others were not familiar with this option. There was a general consensus, though, that while this information was not required frequently, it was clearly important.

Secondly, there were mixed reactions to the quality of the information that was received. Quality was defined by the following requirements:

- **The information must be up-to-date**. Many stories were relayed about driving right into a major traffic problem which was not identified on a traffic report or hearing a traffic report about a major problem which had already cleared up. If the information is to be useful, it should be timely.

  Some of the individuals who rely on this information most heavily had cellular phones in their cars. They indicated that some radio stations use drivers with cellular phones for updating traffic patterns. Given that these were free calls and the degree to which they relied on it, most indicated they were very willing to participate in the process.

- **The information must be specific**. It is vital that the driver know where a traffic problem begins and how far it extends. This is important since it affects the ability to make choices as to whether to avoid the situation and, if so, what alternatives are available.

- **Alternate travel routes should be provided**. This is particularly important because it is not uncommon for drivers to be unfamiliar with alternate paths. This is even true among the routes they drive on a regular basis. Therefore, the more information they can be provided about how to avoid traffic problems, the better.

● <u>Geographic coverage must be reasonable</u>. It must be broad enough to cover the radio listening area but narrow enough not to be overwhelming in terms of the volume of problems. As was discussed previously, it can be rather tiresome to listen to these broadcasts. It is particularly a problem when it goes on and on discussing one road after another. Most of the drivers expressed a desire to somehow have an option to listen to broadcasts that cover either only a small geographic area (city broken up into grids) to listen to a specified grid area they are heading toward or to get a more general report of the whole area. This would allow them to check only on the most relevant areas. Along the same lines, some suggested they would like a system where they could punch in the road number they were going to be on (e.g., 405S in California) and obtain a report just for that road. This could be the very best of the options if it were possible.

● <u>Known problem areas should have special systems</u>. There was a fair amount of interest in location specific radio broadcasts such as that found by airports. This is consistent with their notion of only having to listen to the most relevant traffic information. They felt that this would be useful for any area where any traffic congestion could be expected such as sport stadiums, airports, major downtown areas, and the like.

Most of the discussion above has been directed primarily to traffic accident types of situations. It should be noted that they were just as interested in road construction and weather hazards.

A number of potential options for future systems were discussed. Many
of these options related directly to the problem of proximity and
timing. In particular, the fact that more often than not they were
not listening to the radio broadcasts once they were driving. Thus,
they most likely would not be aware of any new situation that might
occur. The following alternatives were discussed:

- Radio Override - This type of system would automatically be
  broadcast over the radio should the problem occur in the driver's
  quadrant. It would notify the driver of the potential problem and
  alternate routes. Generally speaking, most did not care for this
  system. They felt that at times they didn't want to know about
  traffic problems. With this type of system, they insisted on
  having the option to ignore or turn off the system. Of course,
  such a system would only be useful if it was activated.

- Auditory/Visual Notification of a Potential Problem - With this
  system either a light would go on, there would be a beep or some
  combination of the above to notify a driver of a problem in their
  area. Many of the respondents thought this would be a good idea.
  It would give them the option of listening to the broadcast if
  they wanted. It would be important, though, that such a system
  include the ability to turn the signal off if they did not want to
  hear more about it. Moreover, a number of respondents expressed
  concern over being frightened if the light or audio signal was too

bold. It would frighten them both from the perspective of having a problem coming up as well as potential confusion with the other warning lights on their cars. Thus, it is important that it be separated from other warning systems and that it not be excessively intrusive.

NAVIGATION SYSTEMS

One of the areas currently being researched as a future automotive system is driver navigation. This area was discussed from the perspective of what consumers currently do, as well as how systems might best serve their needs in the future.

A wide variety of navigational approaches were utilized by drivers, depending upon their situation. For local driving, they relied most heavily on written directions and, to a lesser degree on maps. When maps were used, they were most frequently used to prepare their initial directions prior to leaving. On the other hand, for trips of greater distances, maps and TripTiks, in particular, were used quite frequently.

There were great debates about the value of maps for directions. Some individuals found them very hard to read. "I can never get oriented on a map." Others found them nearly impossible to unfold and use in a car. "I always seem to end up with a mess on the seat next to me." Others complained about smaller streets being left off most maps. "They never have the streets I'm looking for." Conversely, TripTiks were viewed as very useful in that they provided only the basic information that might be required for smaller areas at a time. It also provided additional detail that might be useful in a fold-up center section, if desired. Finally, its small size was seen as easier to handle.

The key value of maps, whether they be TripTiks or other, was twofold:

- Maps allow a driver to determine where in the course of a trip they are at any given time. This was viewed as useful in gauging remaining distances.

- Maps are also useful if drivers get lost. It allows them to locate their current position and get back on track.

Thus, while maps have some advantages, they can be difficult to use and, therefore, are rarely used. Once they are driving, people rely most heavily on written-out directions. Most agreed that the ideal directions include the following characteristics:

- Landmarks, such as stores and traffic lights, are viewed as the most helpful way of identifying one's current location and where they are supposed to be making turns.

- Most agree that the most useful directions indicate left and right rather than north, south, east, or west. Many people have trouble understanding north, east, south or west headings, especially when they are in an unknown area.

- Some people like to know the distance they go before making a turn or before a landmark. They find that this helps them stay on course. Unfortunately, many also agree that more often than not the distances given to them as part of their directions are not accurate.

Aside from the most obvious problem with direction inaccuracies, directions are also difficult to read while driving. The more complex and lengthy the directions, the more difficult the problem. In particular, drivers have experienced the following kinds of problems:

- "Whenever I have long directions, I always lose my place....then I have to reread everything while I try to drive."

- "Directions make me nervous....reading them takes my eyes off the road."

- "When I drive at night, I used to pull over to the side of the road to read directions with the light on....I can't read in the dark!"

- "I am terrible at remembering street names....I keep having to refer back to my directions."

To make matters more complex, most individuals do not keep track of just the next item in their directions. Rather, they like to know at least the next two items coming up so they are prepared. During the course of the sessions, some respondents combined the notion of a head-up display and directions. Based on this combination, they foresaw having their directions automatically displayed on the windshield. They thought this would eliminate the problems of looking down to read, recalling directions, and having to handle the paper on which the directions were written. All the respondents with

the exception of those who were convinced that the head-up display would interfere with their vision thought this would be a great idea.

The notion of having maps on a touch screen display was also discussed. There were initial concerns that this could be very distracting during the course of driving and that the maps would have to be large enough so as not to distract attention from the road. Moreover, if it was to be useful, it would also have to provide options as to whether it gave very general map coordinates or provide a more detailed street map. Ideally, most respondents felt that such a system would have the following characteristics:

- It would work similar to a TripTik in that it would show a general map with the route highlighted.

- Each map frame would show distances between key points and would also show a rough estimate of the location of your vehicle on the map.

- It would provide distance and time estimates between points on the map, as well as estimated time of arrival based on the final destination.

- It would provide the opportunity to call up a detailed map for any key point on the more general map. This would allow for plotting alternate routes should problems occur with traffic or for digressions from the planned trip.

- Ideally, this system would work in coordination with a head-up display. The head-up display would either show the map on the windshield and/or the directions as discussed above.

There were many concerns about a navigational system. The largest concern was how the routes would be programmed. If an individual had to program the route, the likelihood of using it would be greatly diminished compared to a system that automatically generated routes. "I don't see how it would be worth my time and effort to program it." A system that automatically plotted routes also would have the added benefit of making route changes along the way should problems be encountered.

There was also a great deal of concern over how different geographic areas would be covered. "Would I have to buy disks or computer chips to cover each geographic area I go to? How expensive would these chips or disks be?" Some even suggested a library system where they could borrow them if they were only going to an area on a one-time visit. There were also concerns over how many areas it could be equipped with maps for at any given time.

Most respondents had some difficulty determining how they would use this system. They did not see it as useful for general area driving. They saw it as something they would mainly use if they were going on an extended vacation or if they were a business person who drove to new areas all the time. Others could not see much value in a navigational system.

YELLOW PAGE SEARCHES

The final subject discussed was the capability of doing information searches in the vehicle. This primarily referred to the ability to conduct "yellow page" searches while in a car. Thus, a driver who needed to go to a hardware store would be able to determine where in his area there were hardware stores.

There was only average interest in this type of system. Most people felt that when they left their house, they were fairly well prepared for any excursions they may be making. They also felt it would be rare that they would ever make use of this type of system. While it might be nice to have on rare occasions, it certainly would not be worth paying much for.

CONCLUSIONS & RECOMMENDATIONS

We have carefully reviewed the findings as presented in this report.
Based on these findings and our experience in the automotive industry
and in marketing in general, we have developed the following
conclusions and recommendations.

1) <u>WARNING SYSTEMS</u>

Of all the areas examined, warning systems clearly was of the
greatest concern to consumers. Cars have become so
technologically advanced that drivers are not comfortable with
maintenance and are fearful of problems that may quickly develop
while driving. These systems are viewed as a way of supplying
comfort in their ability to foretell potential problems. If these
systems are to be truly useful, they must warn the driver at an
early enough time so that the vehicles may be repaired before
totally breaking down. Moreover, they must in some way let the
driver know the specific nature of the problem and what course of
action is required.

Specifically, most have agreed that they would like some
combination of gauges and either audio or warning lights for the
most important vehicle systems....those that affect the vehicle's
ability to operate. The audio and warning light would draw their
attention to the gauge to notify them of potential problems, while
the gauge would indicate the degree of seriousness. Ideally,

there would also be some easy way to determine what course of action is required.

Consumers are very interested in having their vehicles notify them of any fluid level that may be low, as well as other basic potential problems. These systems need not be handled in as extensive a manner. This is also viewed as a warning system not readily available on most cars.

2) TRIP COMPUTERS

Attitudes toward these devices vary greatly by the extent to which an individual relies on the car. Those who rely most heavily on their cars use the trip computers quite extensively. They found the features easy to use and helpful. More typical drivers relied on it much less extensively. They viewed it more as a "toy" that, at best, provided accurate information and, at its worst, contained features that were too difficult to operate to make them worthwhile for general usage. Most agreed that the trip computer should be part of the warning system by providing diagnostics on the vehicle, as well as some basic trip functions which might be primarily used on extensive trips.

3) CELLULAR PHONE/CITIZEN BAND RADIOS

These devices are viewed as either a godsend or an invasion of one's privacy. Many see them as a way to expand the productivity of their jobs and as a safety device should they have car

problems. Others view them as an intrusion of the only isolated time they have during the day. All agree, though, that they are here to stay and should be made as easy to use and as safe as possible.

There is a consensus among all that there are serious safety concerns with these devices. The primary safety problems are encountered when dialing out and when holding a receiver which requires the driver to look away from the road and to occupy one hand. Many feel that speed-dialing is a necessity to overcome the former problem. If this could be combined with some form of key pad on the dashboard, then dialing becomes less of a problem. For the latter problem, many agree that it should be mandated that these devices only be used in a hands-free mode while in motion.

4) ENTERTAINMENT SYSTEMS

For the most part, entertainment systems are viewed as relatively straightforward and easy to use. The primary problems encountered are on the most sophisticated systems where there are numerous buttons. With these systems, it can be difficult to identify the appropriate button while driving. Some also complain that with these systems it can be difficult to identify the correct button at night.

5) **TOUCH SCREEN DISPLAYS**

These are viewed with much trepidation by most drivers. They are concerned that the displays are so complex that they would be a distraction while driving. Moreover, they see little value at the current time in the advanced systems that might be possible with these screens.

6) **HEAD-UP DISPLAYS**

There is a great deal of interest but also hesitation with these systems. Those who have used a head-up display find them very safe and an asset. Very few drivers, though, have actually seen them in use. They are concerned that they would be distracting. There are also concerns that working the switch to turn it on and·off would just be another distraction to the driver.

More fundamentally, some question whether viewing the speedometer and key gauges on the windshield would have much of a safety impact on their driving. They believe that this takes no more than a split second on a normal basis.

7) **NAVIGATIONAL SYSTEMS**

For the most part, these are viewed as very futuristic. There is not much of a perceived need for this type of system. Such a system would only be truly useful if it could automatically program routes. Otherwise, it was seen as requiring complex programming which they would most likely not undertake.

Ideally, a navigational system would include some combination of written directions and maps. The directions would provide information such as which direction to turn, on what roads, after driving how far, and at what landmarks. The maps would ideally take a TripTik format showing more general maps with the ability to zero in on more detail on more specific areas. The key benefit of the map is that it would show progress and allow for determining alternatives if the driver got lost.

The only true need identified during this discussion was based on the problem of handling and reading handwritten directions. Fumbling with the paper and reading the directions, especially at night, can be a very dangerous and distracting task. There was a great deal of interest in a potential system which would utilize a head-up display to project their written instructions on the windshield. This system was viewed as being potentially easy and offering tremendous potential for increasing safety.

8) ROAD-WARNING SYSTEMS

Drivers were aware of and regularly use the current systems available -- primarily radio stations. They view them as very helpful in avoiding problem areas. If these systems are to be more helpful in the future, however, they must provide accurate up-to-date information. They should provide alternate route

information as well. Finally, there should be some form of system that provides the opportunity to get more specific information on smaller regions, either where they are located or into which they are driving. This would help avoid the clutter present on a more comprehensive system.

APPENDIX A: THE SCREENING QUESTIONNAIRE

AUTOMOTIVE TECHNOLOGY STUDY
STUDY #452-1Q

NAME_____

ADDRESS_____ CITY_____ ZIP_____

PHONE_____ INT._____

1) Hello, I'm _____ from _____. We are conducting a brief survey on electronic
    technology in automobiles. I'd like to ask you a few questions.

A) During the past six months, have you personally participated in any market
    research interviews?

        No ( ) GO TO Q. B   Yes ( ) ASK: Was the interview. . .

                        Conducted in person in your
                        home or in a shopping mall?   ( )

                        Over the phone?   ( )

                OR   Was it a round table discussion
                      with a small group of people?   TERMINATE

B) Does any member of your household or immediate family work for an advertising
    agency or market research firm? IF YES, TERMINATE.

1) To begin with, I'd like to know what make, model and model year of car you
    personally drive.

        Make _____   Model_____   Model year_____

INTERVIEWER'S NOTE: ALL RESPONDENTS SHOULD HAVE VEHICLES FROM THE 1988, 1989
OR 1990 MODEL YEARS.

---

2) I'm going to read you a list of features which you may have on your car. For
    each feature listed, I'd like to know whether you have it on your current car.
    For those features you don't have, I'd like to know if you have ever heard of
    this feature.

	HAVE FEATURE	DO NOT HAVE FEATURE	FAMILIAR WITH IT YES NO	
Cellular phone	( )	( )	( )	( )
C.B.	( )	( )	( )	( )
Compact Disk player	( )	( )	( )	( )
*Trip computer	( )	( )	( )	( )
*Touch-display screen	( )	( )	( )	( )
*Head-up display	( )	( )	( )	( )
*ETAK navigator	( )	( )	( )	( )

INTERVIEWER'S NOTE: AT LEAST TWO-THIRDS OF THE RESPONDENTS IN EACH SESSION
SHOULD HAVE ONE OR MORE OF THESE FEATURES ON THEIR CURRENT VEHICLE. NO MORE
THAN ONE-THIRD MAY HAVE ONLY A CELLULAR PHONE. RESPONDENTS WHO DO NOT HAVE
FEATURES SHOULD BE FAMILIAR WITH ONE OF THE STARRED FEATURES.

---

3)   What percentage of the time would you say you drive in very heavy traffic?

Less than 25%	( )
25% - 49%	( )
50% - 74%	( )
75% or more	( )

INTERVIEWER'S NOTE: AT LEAST HALF THE GROUP SHOULD CONSIST OF PEOPLE WHO DRIVE IN HEAVY TRAFFIC AT LEAST 25% OF THE TIME.

---

4)   Which, if any, of the following physical impairments do you have that in some way limit your ability to drive and use vehicle features?

Problems with night vision   ( )

Arthritis or other ailments that limit finger dexterity   ( )

Other problems *SPECIFY* _____

INTERVIEWER'S NOTE: AT LEAST HALF OF THE 6:00 P.M. GROUP SHOULD HAVE SOME FORM OF PHYSICAL IMPAIRMENT.

---

5)   Next, I would like to get an idea of how comfortable you are with new electronic gadgets in general. Which of the following statements best describes you?

I am very intrigued by new electronic gadgets. I
usually seek out information and like to bring them
into my life at the first opportunity.   ( )

I am somewhat comfortable with new electronic
gadgets. While I do not seek them out, I am
comfortable learning how to make use of them.   ( )   *EVEN*
                                                                                      DISTRIBUTION

I get nervous with things that use a lot of new
electronic gadgetry. I have a hard time figuring
them out and tend to avoid these features when I can.   ( )

New electronic gadgets make me very nervous. I
avoid them at all costs.   *TERMINATE*

6)   Which of the following groups best describes your age?

Under 21	( )
21 - 35	( )
36 - 50	( )
51 - 65	( )
Over 65	( )

INTERVIEWER'S NOTE: THE 6:00 P.M. GROUP SHOULD CONSIST OF AN EVEN DISTRIBUTION OF INDIVIDUALS OVER THE AGE OF 50. THE 8:00 P.M. GROUP SHOULD INCLUDE AN EVEN DISTRIBUTION OF THOSE AGED 50 AND UNDER.

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7) This project is being conducted in conjunction with the United States Department of Transportation and the University of Michigan Transportation Research Institute. We are investigating how new technologies in automobiles impact people while they drive their vehicles. The purpose is to find ways to make current systems more useful in the future and to make future high-tech systems easier to use. We have too many questions to ask over the telephone. Because of this, we will be holding a session with a group of people like yourself to discuss these issues in detail. We would very much like you to join us for this discussion. The discussion will be held on _____. at _____ p.m. and will last roughly an hour and a half. In appreciation of your attending, you will receive $50. Can we count on your attending? *IF YES, CONTINUE.*

8) Finally, I have a couple of questions strictly for background purposes. What is the highest level of education that you have completed?

Some high school   ( )

High school graduate   ( )

Some college   ( )

Four year college graduate   ( )

Professional/medical/graduate work   ( )

9) What is your occupation?

SPECIFY _____

10) Finally, which of the following groups best represents your total household income before taxes?

Under $25,000   ( )

$25,000 - $49,999   ( )

$50,000 - $74,999   ( )

$75,000 - $99,999   ( )

$100,000 or more   ( )

11) Record sex.   Male   ( )

                         Female   ( )

Stamford, Connecticut

6 p.m. Session

AGE	EDUCATION	INCOME	SEX	VEHICLE		FEATURES
51-65	HSG	$25-49,999	F	Ford Bronco	1989	CP, CB, TC
51-65	SC	$100,000 +	M	Chevrolet Suburban	1990	CP, CB, CD, TC
51-65	HSG	$50-74,999	F	Chevrolet Corvette	1990	CD, TC
51-65	CG	$50-74,999	M	Acura Legend	1989	TC
51-65	CG	$100,000 +	M	Chevrolet Caprice	1988	CB, TC
51-65	SC	$25-49,999	M	Volvo 760T	1989	CB
51-65	SC	$50-74,999	F	Isuzu Trooper	1988	TC
51-65	CG	R	M	Lincoln Town Car	1988	TC
51-65	PG	$25-49,999	M	Mitsubishi Gallant	1990	TC
51-65	PG	$100,000 +	M	Nissan Maxima	1986	TC
51-65				Toyota Camry Wagon	1988	CP

CP: Cellular Phone, **CB:** Citizen's Band Radio, **CD:** Compact Disc Player, **TC:** Trip Computer, **TD:** Touch Display Screen, **HD:** Head Display

EDUCATION: **SHS**–Some High School, **HSG**–High School Graduate, **SC**–Some College, **CG**–Four-year College Graduate, **PG**–Professional/Medical/Graduate work, **R**–Refused

Stamford, Connecticut

8 p.m. Session

AGE	EDUCATION	INCOME	SEX	VEHICLE		FEATURES
21-35	CG	$50-74,999	M	Volkswagen	1988	CP, CB
36-56	HSG	$50-74,999	F	Lincoln Mark	1988	CP, TC
21-35	SC	$25-49,999	F	Saab 900S	1989	CB, CD
36-50	SC	$50-74,999	M	Jeep Cherokee	1989	CP, TC
21-35	CG	$25-49,999	F	Nissan 240SX	1989	HD
21-35	PG	$100,000 +	F	Saab 900S	1989	CP
36-50	CG	$100,000 +	F	Saab 9000	1988	TC
21-35	CG	$75-99,999	M	Peugot	1989	CB
36-50	CG	R	M	BMW 325 IS	1987	CP, CB, TC
21-35	SC	$50-74,999	M	Honda Prelude	1988	TC
36-50	HSG	$50-74,999	M	Chrysler LeBaron	1988	CB
21-35	PG	$25-49,999	M	Ford Taurus SHO	1989	CD, TC

CP: Cellular Phone, CB: Citizen's Band Radio, CD: Compact Disc Player,
TC: Trip Computer, TD: Touch Display Screen, HD: Head Display

EDUCATION: SHS-Some High School, HSG-High School Graduate, SC-Some College,
CG-Four-year College Graduate, PG-Professional/Medical/Graduate work, R-Refused

GROUP PARTICIPANTS

LOS ANGELES, CALIFORNIA

6 p.m. Session

AGE	EDUCATION	INCOME	SEX	VEHICLE		FEATURES			
51-65	SC	$75-99,999	M	Nissan Maxima	1990	TC, HD			
51-65	SC	$50-74,999	F	Nissan Maxima	1989	TC, HD			
51-65	CG	$50-74,999	F	Buick Riviera	1988	TC, TD			
Over 65	CG	$50-74,999	M	Saab 9000T	1988	TC			
51-65	CG	$100,000 +	M	Buick Riviera	1989	TC, CP,	CD,	TD	
51-65	PG	$75-99,999	M	Buick Park Avenue	1989	CB, TC			
51-65	CG	$50-74,999	M	Audi 200	1989	CP, CB,	TC		
51-65	SC	$50-74,999	M	Oldsmobile Cutlass Sup.	1988	TC			
51-65	SC	$25-49,999	F	Chrysler New Yorker	1988	TC			
Over 65	HSG	$25-49,999	F	Dodge Voyager	1989				
Over 65	SC	$25-49,999	M	Mercury Cougar	1988	TC			

CP: Cellular Phone, CB: Citizen's Band Radio, CD: Compact Disc Player,
TC: Trip Computer, TD: Touch Display Screen, HD: Head Display

EDUCATION: SHS-Some High School, HSG-High School Graduate, SC-Some College,
CG-Four-year College Graduate, PG-Professional/Medical/Graduate work, R-Refused

GROUP PARTICIPANTS

LOS ANGELES, CALIFORNIA

8 p.m. Session

AGE	EDUCATION	INCOME	SEX	VEHICLE		FEATURES		
51-65	HSG	$100,000 +	M	Jeep Cherokee	1990	CB		
21-35	SC	$50-74,999	M	Chevrolet Corvette	1990	CP, CB, TC		
21-35	SHS	$25-49,999	F	Mitsubishi Precis	1988	TC		
21-35	SC	$75-99,999	F	BMW 325 IS	1990	CP, CD TC		
36-50	SC	$25-49,999	M	Oldsmobile Cutlass Supreme Int.	1990	CD, TC, HD		
36-50	CG	$25-49,999	M	Cadillac Coupe de Ville	1990	CD, TC		
36-50	SC	$25-49,999	F	Isuzu Impulse	1988			
21-35	SC	$100,000 +	F	BMW	1989	CD, TC		
36-50	SC	$50-74,999	M	Lincoln Town Car	1988	CP, TC		
21-35	CG	$25-49,999	M	Volkswagen Jetta GLI	1988	TC		
21-35	CG	$75-99,999	F	Jeep Cherokee	1989	CP, CD, TC		
36-50	PG	$75-99,999	F	Volvo 740	1988	CP, CD, TC		

CP: Cellular Phone, CB: Citizen's Band Radio, CD: Compact Disc Player,
TC: Trip Computer, TD: Touch Display Screen, HD: Head Display

EDUCATION: SHS-Some High School, HSG-High School Graduate, SC-Some College,
    CG-Four-year College Graduate, PG-Professional/Medical/Graduate work, R-Refused

APPENDIX B: THE DISCUSSION GUIDE

<u>VEHICLE CONTROL SYSTEMS</u>
<u>DISCUSSION GUIDE</u>

Study #452-1Q

1) Introduction and establishment of moderator/group rapport.

2) Background on respondents' vehicles.

 ● Make, model, and model year of vehicle owned.

 ● Features included on vehicle:

   ● Touch screen

   ● Head-up display

   ● Sophisticated radio/CD

   ● CB

   ● Trip computer

   ● ETAK

3) Discussion of general attitudes toward sophisticated technologies in cars.

 ● General reactions

 ● Do they look for them, avoid them, or are they totally indifferent when they buy cars? Why?

4) General discussion of their usage of these technologies.

 ● Are they used regularly?

 ● Are they used fequently at first and less as time goes on? Why?

 ● Does usage differ by feature? Which ones are used often? Which ones are not?

5) General discussion of how they learn to use these kinds of gadgets.

- Probe for problems associated with learning to use these gadgets.

- Usage of Manuals

  - Do they study instruction books cover-to-cover?

  - Do they only read the most necessary information?

  - Do they figure it out on their own?

6) Detailed discussion of automotive gauges and warning systems.

- Discussion of for what there should be gauges and warning systems. For each, indicate whether it should be a warning light versus a gauge.

  - Engine temperature
  - Oil pressure
  - Oil level
  - Washer fluid level
  - Power steering fluid level
  - Coolant level
  - Brake fluid level
  - Tire pressure
  - Door ajar
  - Gasoline level
  - Engine monitoring
  - Scheduled maintenance
  - Others

- Warning lights versus vehicle display versus audio (tone or speech).

- Examples of experiences where they wished they had been warned about car problems.

- How much information should these systems provide? (e.g., What to do.)

7) Detailed discussion of entertainment systems.

- Experience and attitudes with compact disc players, cassette decks, equalizers and steering wheel mounted control systems.

- Limitations on when they might be used (driving conditions).

  - Day versus night

  - Heavy versus light traffic

  - Other situations

- Which functions are easily accomplished? What makes them easy?

  - Turning on/off

  - Inserting tape/CD

  - Finding stations

  - Setting volume/tone controls

  - Other

- Which functions are difficult to accomplish? What makes them difficult?

  - Turning on/off

  - Inserting tape/CD

  - Finding stations

  - Setting volume/tone controls

  - Other

- Usage of features -- which ones don't they use? Why not?

- How could they be made easier/safer to use?

- Examples of critical incidents associated with using these systems.

- How do they learn how to use this system (manual versus trial and error)?

8) Discussion of experience with sophisticated vehicle monitoring systems, such as CRT based and trip computers.

  - Awareness and experience with these systems (expose to visual and verbal descriptions).

- General attitudes toward these devices.

- Favorable perceptions.

  - Features

  - Ease of using -- reading

  - Ease of using -- touch control

  - Other issues

- Problems with these systems.

  - Features

  - Ease of using -- reading

  - Ease of using -- touch control

  - Other issues

- How they learn to use these systems.

  - Do they know how to use all functions? Why not?

- Problems in difficult driving conditions.

  - Daytime versus night

  - Heavy traffic

  - Other

- Examples of critical incidents associated with these systems.

  - How these systems could be improved . . .

    - To make them more useful

    - To make them easier to use

9) Discussion of attitudes and experience with cellular phones and CB's.

  - Awareness and experience with these systems

  - General attitudes toward them

- Favorable aspects of these systems

  - Hands-free dialing

  - Speed dialing

  - Other dialing systems

  - Auto-muting of radio

  - Hands-free

  - Ease of using the controls

  - Other issues

- Problems with cellular phones/CB's

  - Hands-free dialing

  - Speed dialing

  - Other dialing systems

  - Auto-muting of radio

  - Hands-free

  - Ease of using the controls

  - Other issues

- Limitations in their usage based on driving conditions

  - Congestion

  - Day versus night

  - Other

    - Incoming versus outgoing

    - Other problems

- How do they learn to use their cellular phone/CB?

  - Usefulness of the materials utilized

- Usage of all features versus only selected features

- Examples of critical incidents using these systems

- Recommendations for how these could be made easier to use

10) Discussion of attitudes and experience with the navigational systems.

- Current methods utilized for navigation

    - Regular maps

    - TripTiks

    - Written directions

- What type of information do they need for directions?

    - Pictures versus words

    - Distances

    - Which way to turn

    - A placement of traffic lights

    - Other land marks

    - Other information

- How do they use maps while driving?

    - Use it themselves versus navigator

    - When stopped versus when driving

- Awareness and experience with these systems (show materials and explain).

- Favorable attitudes toward the navigational system

    - Quality of directions

    - Ease of use

    - Detailed instructions

- Problems with the system

  - Quality of directions

  - Ease of use

  - Detailed instructions

- Perceived ideas for improving the system

11) Discussion of experience and attitudes toward monitoring road hazards.

  - Usage of traffic information from radio/TV

    - Prior versus during driving

    - Frequency of usage

    - Relevance of information provided

- What type of road hazards would they like to be able to receive information on?

  - Blind curves

  - Disabled vehicles

  - Approaching emergency vehicles

  - Icy/slippery conditions

  - Accidents

  - Other traffic delays

  - Railway crossings

- If systems were available to provide these types of information . . .

  - How frequently would they use it?

  - When would they use it (business versus pleasure)?

  - Under what other circumstances?

  - What would be the best approach for such a system?

- Warning lights on vehicle

- Radio information

- CRT display

12) Discussion of In Vehicle Information Search Systems.

13) Summary Discussion